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HM-598

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Dirk Mangler, et al.

Serial No: 10/509,861

Filed: October 1, 2004

For: ADJUSTING OF HEAT TRANSFER IN CONTINUOUS CASTING MOLDS IN PARTICULAR IN THE REGION OF THE MENISCUS

Examiner: Len Tran

Art Unit: 1725

Mail Stop: Appeal Brief-Patents
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

BRIEF ON APPEAL

S I R:

This appeal is taken from the Final Action mailed February 2, 2006.

Real Party in Interest

The real party in interest in the above-identified application is:

SMS Demag AG
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Germany

Related Appeals and Interferences

There are no related appeals or interferences of which Applicants are aware regarding the above-identified application.

Status of Claims

Claims 6-11 have been canceled. Claims 1-5 are pending in the application and are subject to the present appeal. Claims 1-5 stand rejected under 35 U.S.C. 102(b) over British reference GB 1,082,988.

Status of Amendments After Final Rejection

A Response after final was filed but no changes were made to the claims.

Summary of the Claimed Subject Matter

The claimed invention will now be summarized with reference to the drawings being made by way of reference numerals and reference to the specification being made by page and line numbers.

The claimed invention recites a mold for the continuous casting of molten metals, especially steel, with cooling channels (1), such as grooves, slits, or bores, in the side (2) of the mold that faces away from the melt contact surface (see page 1, lines 3-6 of the specification of the present application, all further references in this summary to page and line numbers refer to the specification). In the mold, in conformity with the

design of the cooling channels (1), the cooling effect of the cooling channels (1) is maximized in the region of the maximum heat flux density or the maximum temperature of the contact surface (18). The local heat-transfer cooling channel surfaces are adapted varyingly via geometric designs of the heat-transfer surface areas of a cooling channel (1) or of a group of cooling channels in shape, cross-sectional area, circumference, boundary surface properties, and orientation relative to the contact surface (see page 13, lines 3-7, Figs. 10 and 11) to the local development of the heat flux density and/or temperature of the contact surface (18) in the casting operation (see page 17, lines 13-17, page 19, lines 7-17, and Figs. 6-7). To influence the local cooling intensity of a cooling channel (1), its effective heat-exchange surfaces on the base of the channel or on the lateral surfaces are increased or decreased (see page 13, lines 8-10, page 17, lines 6-12, and Figs. 1, 10 and 11). To influence the local cooling intensity of a cooling channel (1), its isoperimetric cross-sectional area is increased by providing additional grooves in the base or lateral surfaces or decreased by inserting displacement bodies (see page 13, lines 11-14, page 17, lines 6-12, and Figs. 1, 10 and 11).

Grounds of Rejection to be Reviewed on Appeal

The following grounds are presented for review:

Whether claims 1-5 are anticipated under 35 U.S.C. 102(b) over GB '988.

Argument

The Rejection of Claims 1-5 under 35 U.S.C. 102(b):

In rejecting claims 1-5, the Examiner stated the following in the final rejection:

"As to claims 1 and 5, GB '988 disclose a mold for continuous casting comprising cooling channels, such as bores, in the side of the mold. The varyingly geometric design of the heat transfer surface areas of a cooling channel are adapted in shape, cross-sectional area, to the local development of the heat flux density in the casting operation. The effective heat exchange surfaces on the base of the channel can be increased or decreased, to influence the local cooling intensity (figures).

As to claim 2, wherein grooves (section at 10) additionally introduced to increase heat exchange surfaces in the cooling channels.

As to claim 3, the cooling channels are altered as shown in the figure to influence cooling intensity.

As to claim 4, grooves are produced in the base as shown in the figures to promote cooling intensity."

Turning now to the reference, it can be seen that GB 1,082,988 discloses a cooled mold for continuous casting of metal. GB'988 has a publication date of 1967. The problem being addressed by GB'988 is that at in 1967 it was not possible to put cooling water bores of small diameter in the wall of the mold. Thus, those skilled in the art in 1967 were compelled to put bores with large diameter in the mold walls, and to fill the large bores with displacement plugs in order to achieve the necessary flow speeds to realize cooling of the mold. The drawback of this is the increased pressure needed for the cooling water and the corresponding higher pumping power.

GB'988 avoids the flow losses and the high pumping load through a specific construction of the plugs (see especially Figs. 12-17).

At no point does GB'988 disclose or suggest that the "cooling

channel surfaces are adapted ... in shape, cross-sectional area, ... to the local development of the heat flux density ... in the casting operation...", as in the presently claimed invention.

The necessity of the local, varying matching of the cooling channel surfaces of a mold to the respectively locally controlling temperature of the mold in the casting direction and therewith to the locally varying necessary heat transfer, was not known to those skilled in the art at the time of GB'988. The Examiner's position that GB'988 discloses the presently claimed invention is at best based on impermissible hindsight. In applicant's opinion GB'988 makes no disclosure of the presently claimed invention.

In the presently claimed invention the local heat-transfer cooling channel surfaces are adapted varyingly via geometric designs of the heat-transfer surface areas of a cooling channel or of a group of cooling channels in shape, cross-sectional area, circumference, boundary surface properties, and orientation relative to the contact surface to the local development of the heat flux density and/or temperature of the contact surface in the casting operation. Such a construction is not disclosed by the reference. Figure 6 of the present application shows the technical background of the invention. The figure shows the heat

flux density q_{max} as a function of the height of the mold in a bordered region below the molten metal level. Figure 7 shows the temperature curve T as a function of mold height, with a maximum temperature T_{max} within the region below the molten metal level. The depth R of the grooves in the cooling channel relative to the height of the mold is shown in Figure 7 with the corresponding path of the temperature curve T, which is already to a great degree matched to the path of the heat flux density q in Figure 6. This is discussed in the paragraph beginning on line 5 of page 19 of the application, as follows: "the temperature curve T … shows a temperature maximum T_{max} between points 14 and 15 with R_{max} within the region 13 to 17 of variable depth R of the heat-exchange grooves. The heat-exchange grooves 3 begin at 13 at the height of the molten metal level. The maximum groove depth 4 is reached at point 14. This maximum groove depth continues as far as point 15, and then the groove depth is reduced to the original level as point 16 is approached."

Figure 9 of the present application shows the local heat flux density/temperature in the flow direction of the mold. Also here the maximum heat flux density q_{max} or the maximum temperature T_{max} are shown in the region directly under the molten metal level. In adapting to the shape of the path of the local heat

flux density the right side of Figure 9 shows the path of the local heat transfer of the cooling channel surface. This adapting takes place by variable number, form or depth of the cooling channel grooves. Such a construction is not disclosed by the reference.

Conclusion

Accordingly, in view of the above considerations, it is Applicant's position that the Examiner's rejection of claims 1-5 under 35 U.S.C. 102(b) over GB '988 is in error and should be reversed.

The amount of $500.00 to cover the fee for filing an appeal brief is being charged as per attached form PTO-2038. Any additional fees or charges required at this time in connection with this application should be charged to Patent and Trademark Office Deposit Account No. 11-1835.

Respectfully submitted,

By

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, PO Box 1450 Alexandria, VA 22313-1450, on October 10, 2006.

By: ______________________ Date: October 10, 2006
Friedrich Kueffner

Claims Appendix

1) Mold for the continuous casting of molten metals, especially steel, with cooling channels (1), such as grooves, slits, or bores, in the side (2) of the mold that faces away from the melt contact surface, in which mold, in conformity with the design of the cooling channels (1), the cooling effect of the cooling channels (1) is maximized in the region of the maximum heat flux density or the maximum temperature of the contact surface (18), wherein the local heat-transfer cooling channel surfaces are adapted varyingly via geometric designs of the heat-transfer surface areas of a cooling channel (1) or of a group of cooling channels in shape, cross-sectional area, circumference, boundary surface properties, and orientation relative to the contact surface to the local development of the heat flux density and/or temperature of the contact surface (18) in the casting operation, such that to influence the local cooling intensity of a cooling channel (1), its effective heat-exchange surfaces on the base of the channel or on the lateral surfaces are increased or decreased, and to influence the local cooling intensity of a cooling channel

(1), its isoperimetric cross-sectional area is increased by providing additional grooves in the base or lateral surfaces or decreased by inserting displacement bodies.

2) Mold in accordance with Claim 1, wherein grooves or scores additionally introduced to increase the heat-exchange surfaces in the cooling channels are cross-sectionally shaped as rectangles, triangles, trapezoids, circular or elliptical segments, or any desired free forms and are adapted to the course of the cooling channels in their number, depth, and width, and in their relative positioning parallel to one another or in some other desired arrangement.

3) Mold in accordance with Claim 1, wherein the heat-transfer surfaces of the cooling channels (1) are altered with respect to their boundary surface properties to influence the local cooling intensity, e.g., by producing well-defined surface roughness for increased heat transfer or by applying additional layers for reduced heat transfer.

4) Mold in accordance with Claim 1, wherein, to influence the

local cooling intensity of a cooling channel (1) and to alter the coolant flow, which is initially aligned straight relative to the contact surface, additional grooves are produced in the base and/or lateral surfaces of the cooling channel, or additional displacement bodies are inserted, and/or an altered wall shape of the cooling channels (1) is provided.

5) Mold in accordance with Claim 1, wherein, to influence the local cooling intensity, the cooling channels (1) are arranged locally or overall with respect to their distance from the contact surface and/or their density of arrangement, i.e., the number of cooling channels per unit length of the mold width.

Evidence Appendix

N.A.

Related Proceedings Appendix

There are no related proceedings.